NEW YORK ENTOMOLOGICAL SOCIETY
LXXXVI(3), 1978, pp. 137–143

MIRID FAUNA ASSOCIATED WITH OLD-FIELD GOLDENRODS (*SOLIDAGO*: COMPOSITAE) IN ITHACA, N.Y.

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Abstract.—Messina, Frank J., Section of Ecology and Systematics, Cornell University, Ithaca, N.Y. 14853.—The mirid fauna associated with old-field goldenrods (*Solidago* spp.) was sampled from May 10 to October 25, 1977 in Ithaca, N.Y. Twenty-three species belonging to 16 genera were recorded; 97% of all individuals (1,099) belong to 6 genera (*Lygus, Slaterocoris, Lopidea, Plagiognathus, Adelphocoris* and *Polymerus*). The tarnished plant bug, *Lygus lineolaris,* was the most common species. The dominant mirids can be divided into 2 fairly distinct guilds, *Lygus lineolaris,* 2 *Plagiognathus* spp. and *Adelphocoris rapidus* feeding primarily on goldenrod flowers, and 3 *Slaterocoris* spp., *Lopidea media* and *Polymerus venaticus* feeding on the immature foliage. The phenological pattern exhibited by these species can be broadly explained by this difference in resource utilization. Observations on the biology of certain species are presented.

Received for publication February 20, 1978.

Introduction

The genus *Solidago* contains over 100 species in North America (Fernald 1950). Recent studies have been directed toward the niche relationships of co-occurring species (Abrahamson and Gadgil, 1973; Werner and Platt, 1976), but little is known about the phytophagous insect loads of *Solidago* spp. This paper, as part of a larger study examining certain herbivores of old-field goldenrods, describes the mirid fauna found on *Solidago* spp. in Ithaca, N.Y.

The mirid faunas associated with several host plants have been described (e.g. Waloff and Southwood 1960, Dempster 1964, Wheeler 1974). Reid et al. (1976) collected 46 species of Miridae in sweep samples of *Solidago canadensis* at 4 sites in southeastern Ontario. Only 7 "resident" species, however, accounted for 90% of all individuals sampled; these species occurred in a "rigid phenological order" with little temporal overlap among the dominants. An example of geographic variation in the goldenrod-mirid association is presented here; results from the two locations can be compared in terms of species composition, abundance, and seasonality.

Description of the Study Site. The area sampled is an abandoned hay field

on the Whipple Farm near Ithaca, N.Y. The field is rectangular (70 m × 150 m), bordered on the east and west by tree hedgerows, on the north by a field of dense shrubs (predominantly *Viburnum* sp.), and on the south by a paved road. Recently it has been mowed on a 3-year cycle. The entire field is strongly dominated by *Solidago* spp., which form a near monoculture. *Solidago* density and species composition was estimated by taking a random series of 20 0.25 m^2 quadrats. The mean density of goldenrod stems was 65 stems/m^2; the relative abundance was 64% *S. altissima*, 23% *S. rugosa*, 9% *S. graminifolia* and 3% *S. gigantea*. *S. juncea* was present but occurred in an overall density of less than 1%. The remainder of the vegetation consisted of grasses and sparsely distributed forbs including *Aster* spp., *Erigeron* spp., *Hieracium* spp., *Daucus carota*, *Plantago* sp. and *Dipsacus sylvestris*.

Materials and Methods

Sweep samples were taken at approximately weekly intervals from 10 May to 23 October 1977. Fifty sweeps were taken along 4 permanent transects on each sampling day (200 sw/day). The transects were chosen to represent all major portions of the field; 2 of the transects were located in N–S direction and 2 ran E–W. Sweeps were made with a 43 cm diameter net along the tops of the goldenrod stands. Once the plants were in bloom the sweeps were made just below the panicles. Samples at each transect were placed in a 3.8 l jar with a small amount of chloroform. Samples were sorted in the laboratory and stored in 70% alcohol. Mirid specimens were identified to species except for 2 groups which were identified to genus. Selected specimens of these 2 genera were later identified to species. Voucher specimens of the dominant mirid species were placed in the Cornell University Collection under Lot. No. 1068.

Results and Discussion

A total of 1,099 individuals representing 23 species (Table 1) of mirids were taken in sweep samples. This total was divided rather evenly among the 4 transects (SS1 = 227, SS2= 288, SS3 = 259, SS4 = 275), suggesting that mirid abundance was similar in each portion of the field. Most of the species discovered were relatively rare, and many are probably not associated with goldenrods during any part of their life cycles. Of all mirids collected, 97% belong to six genera: *Lygus*, *Slaterocoris*, *Lopidea*, *Plagiognathus*, *Adelphocoris* and *Polymerus*. These mirids were observed on all goldenrod species, but were rarely found on the foliage of *S. graminifolia*. Biological notes on the dominant species follow.

Lygus lineolaris (Palisot de Beauvois), the tarnished plant bug, was the most common species. This mirid is a well-known economic pest and feeds

Table 1. Species of Miridae collected from sweep samples in an old field from 10 May to 23 October 1977. Nymphs of *Slaterocoris* and *Lopidea* were recorded separately.

Species	No. of Individuals
Lygus lineolaris (Palisot de Beauvois)	176
Slaterocoris Wagner	
S. breviatus (Knight)	144
S. atritibialis (Knight)	109
S. stygicus (Say)	77
Slaterocoris nymphs	100
* Lopidea Uhler (Adults)	132
Lopidea nymphs	59
L. media (Say)	
L. marginalis (Reuter)	
L. heidemanni Knight	
* Plagiognathus Fieber	111
P. cuneatus Knight	
P. politus Uhler	
Adlephocoris rapidus (Say)	86
Polymerus venaticus (Uhler)	52
Adelphocoris lineolatus (Goeze)	14
Plagiognathus chrysanthemi (Wolff)	8
Leptoterna dolobratus (F.)	6
Prepops nigricollis (Reuter)	6
Capsus ater (L.)	4
Megalocerea recticornis (Geoffroy)	4
Orthocephalus coriaceus (F.)	3
Phytocoris sp.	2
Horcias dislocatus (Say)	2
Collaris meilleurii Provancher	2
Poecilocapsus lineatus (F.)	1
Stenotus binotatus (F.)	1
TOTAL	1,099

* Individuals of these genera (except for specimens of *Plagiognathus chrysanthemi*) were not determined to species for each sample. Subsequent determinations indicated the species listed here under the generic name. See text for further discussion.

on many different plant species (Taksdal 1963, Kelton 1975). Unlike the other common mirids, this species overwinters as an adult and 3 full generations occur in Ithaca (see also Ridgway and Gyrisco 1960, Wheeler 1974). Adults were found flying in Ithaca as early as 10 March 1977 and individuals of this species persisted beyond the last sampling date on 23 October 1977. This species was most abundant in the old field from mid-August until late September (Fig. 1). The peak in abundance corresponded with the apparent availability of composite flowers. Tarnished plant bugs were observed in

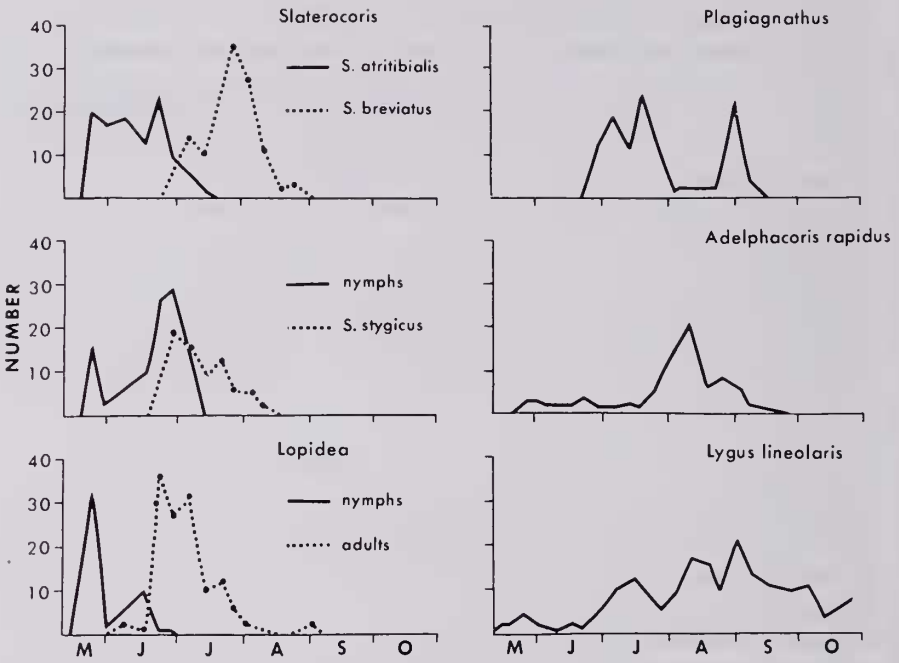

Fig. 1. Seasonal abundance of common mirids collected from sweep samples in 1977. Nymphs of *Slaterocoris* and *Lopidea* were recorded separately.

July on the earlier blossoms of *Erigeron* and were subsequently common on *Solidago* spp. and *Aster* spp. Doubtless more specimens would have been collected if sweeps had been made through the *Solidago* inflorescences where the bugs were most often found. Large numbers of nymphs may be collected by shaking goldenrod panicles in alcohol (up to 30/panicle, unpublished data), suggesting that females commonly oviposit on or near the fall flowers. The phenological pattern is similar to that found by Reid et al. (1976), where large numbers of individuals seem to disperse onto goldenrod plants upon flowering. These results support their statement that attempts to control this bug may be thwarted by continual replenishing of *L. lineolaris* populations on non-crop plants such as the ubiquitous goldenrods.

Lygus vanduzeei (Knight), which is listed as being restricted to or primarily feeding on goldenrod (Knight 1941, Kelton 1975), was not sampled in the study area. Yet this species, a "resident" component of the fauna (Reid et al. 1976), was fairly abundant in a similar old field located less than 400 m from the study site (the 2 fields are separated by an area of dense shrubs). At that site as many as 40 individuals were collected in 200 sweeps. Such spotty distribution was also noted for the nymphs by Reid et al. (1976) and contrasts sharply with the more even distribution of the tarnished plant

bug. Observations suggest that the patchy distribution of *L. vanduzeei* could result from a relatively low dispersal tendency or more restricted overwintering sites.

The 3 species of *Slaterocoris* recorded from the study area are all known to feed primarily on goldenrod (Leonard 1919, Knight 1941, Reid et al. 1976). Nymphs of the genus show a somewhat bimodal distribution (Fig. 1) which corresponds to the abundance of the adults. *S. breviatus* (Knight) was the most common adult, followed in order of abundance by *S. atritibialis* (Knight) and *S. stygicus* (Say). This order was also found by Reid *et al.* (1976) but in Canada *S. breviatus* was relatively more common; it was 25 × as abundant as *S. atritibialis*, and *S. stygicus* was virtually absent. In Ithaca the differences in abundance were not very large (Table 1) and more significantly, the phenology of *S. stygicus* overlapped considerably with *S. breviatus* (Fig. 1). On 2 occasions, individuals of *S. atritibialis* on laboratory plants were found feeding on the eggs of a goldenrod chrysomelid, *Ophraella sexvittata* (Leconte). This is apparently the first report of predation by this genus. "Facultative predation" has been recorded in the field and laboratory for several "phytophagous mirids" (Wheeler 1974, 1976) and may be an important component of their feeding niche.

Lopidea spp. were common but individuals could not be determined to species for each sample. Subsequent determination indicated that individuals sampled before 27 July (and thus the majority of specimens collected, Fig. 1), are *Lopidea media* (Say). These bugs are known to feed on *Solidago rugosa* (Knight 1941) and were observed on other goldenrods. This species was apparently absent from the 4 sites sampled by Reid et al. (1976). Two other *Lopidea* spp. were found in August and September, *L. marginalis* Reuter and *L. heidemanni* Knight. These are listed as feeding on non-goldenrods (Knight 1941, Wheeler 1974) and were rare. Nymphs of this genus (Fig. 1) were collected early in the season and were probably *L. media*.

Except for the distinctive *Plagiognathus chrysanthemi* (Wolff), which was rare, specimens of *Plagiognathus* were determined only to genus on each sampling date. Later determinations made on a subsample of the collection revealed that approximately 85% of the individuals were *P. cuneatus* Knight, with the remaining specimens belonging to *P. politus* Uhler. *P. cuneatus* was collected from late June to September and is apparently bivoltine in Ithaca (Fig. 1). It was observed almost exclusively on the composite flowers with the first generation predominantly on *Erigeron* spp. and the second on *Solidago* spp. and *Aster* spp. *P. politus* was also found in late June and exhibits a similar seasonal abundance in Ithaca (Wheeler 1974). Neither species was reported to have 2 full generations in southeastern Ontario (Reid et al. 1976) where *P. cuneatus* was also the more abundant species.

The rapid plant bug, *Adelphocoris rapidus* (Say), was present throughout

the season (Fig. 1), but was most numerous in August and September. This species feeds on a variety of herbaceous plants and was found most often on the goldenrod flowers. Nymphs were rarely sampled by the sweep method.

Polymerus venaticus (Uhler) was present in relatively low numbers from early June until late August. This bug is known to feed on goldenrod (Knight 1941, Reid et al. 1976) and was found on the unfolding leaves at the tops of the plants. It is apparently univoltine in Ithaca.

The actual phenological order of the common mirids in this study is similar to that found by Reid et al. (1976). *S. atritibialis* adults appear first followed by *P. venaticus*, *S. stygicus*, *S. breviatus*, *P. politus*, *P. cuneatus* and *L. lineolaris*. *L. vanduzeei* and *L. media* were not found at both study sites and, interestingly, they occupy the same phenological position (with a peak abundance between those of *P. venaticus* and *S. breviatus*). There is, however, considerable overlap among the seasonal abundances of the species in Ithaca, unlike the general condition reported by Reid et al. (1976). The example of *S. breviatus* and *S. stygicus* has been previously mentioned. Other instances of substantial overlap in adult populations would include the appearances of *L. lineolaris*, *A. rapidus* and *P. cuneatus* (Fig. 1). Reid et al. (1976) suggest some sort of "diffuse competition" (not food competition, because goldenrod resources do not appear limiting) to explain the degree of overlap and the predictable phenological order. While this concept is worth considering, it would be misleading to interpret the broad phenological pattern without reference to the particular resource the species utilize. Adults of *L. lineolaris*, *Plagiognathus* spp., and *A. rapidus* seem to feed primarily in the inflorescences of goldenrod and other late-blooming composites. The competition regime among these species, resource based or not, should be considered separately from the regime faced by mirids that feed on vegetative tissue (*P. venaticus*, *Slaterocoris* spp., and *L. media*). It would then be more useful to attempt to explain the phenological pattern within one of these resource guilds, given the constraints of the seasonal appearance of the resource.

Acknowledgments

I thank R. B. Root for comments on the manuscript, A. G. Wheeler, Jr., for advice regarding mirids, and T. J. Henry for identifying specimens of *Lopidea* and *Plagiognathus*. This work was supported in part by NSF Grant No. DEB 77-25120 to R. B. Root.

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